Inclinations of Cometary Orbits to the Ecliptic.

(Containing only Comets which appeared since A.D. 1650.)

						per cent.
0°	to	10°	...	...	20	7·7
10	,,	20	...	...	19	7·3
20	,,	30	...	...	15	5·8
30	,,	40	...	...	30	11·5
40	,,	50	...	...	37	14·2
50	,,	60	...	...	33	12·7
60	,,	70	...	...	32	12·3
70	,,	80	...	...	37	14·2
80	,,	90	...	...	37	14·2
			Total		260	99·9

Here the tendency to a maximum at 50° has entirely disappeared There are in fact more comets in the interval 70° to 90° than in the interval 40° to 60°. But on the other hand there is a very marked deficiency in inclinations from 0° to 30°. In the interval from 30° to 40° we first reach the average number. From 40° to 90° the number is invariably in excess of the average.

If we were at liberty to distinguish comets of short period (which are now known to be pretty numerous) from those which move in very elongated ellipses, parabolas, or hyperbolas, the results would be more striking. Comets of short period have even a more decided preference for small inclinations than the other comets have for large ones. And even if we do not adopt Mr. Proctor's theory, that these comets of short period have been ejected from the planets (especially *Jupiter*), or Professor Kirkwood's suggestion that some at least of them have a common origin with the asteroids, I think there is considerable reason for regarding them as original members of the solar system, exhibiting many of the characteristic properties of that system. If so, it is only to the other and larger class of comets that we can look for information as to the prevailing direction of motions in exterior space; for that their high inclinations to the ecliptic is not caused by anything in the solar system is, I think, certain. A comparison of the inclinations of their orbits with those computed for binary stars would be interesting from this point of view.

On the Orbit of Comet II. 1883.. By Robert Bryant, B.A., B.Sc.

In the *Monthly Notices* for last November Lieut.-General Tennant gave parabolic elements of the orbit of this comet, and expressed his opinion that there is no justification for assigning an orbit with an eccentricity different from unity.

The elliptic elements, which I communicated to the Society in June 1885, depended upon three observations which I considered fairly good ones, and from these the orbit was deduced with great care. The difference between this orbit and that of Lieut.-General Tennant caused me to revise my work and to take into consideration a larger number of observations. Moreover the large residuals given in the middle observed place by Lieut.-General Tennant's parabola seemed to me to indicate that this latter curve scarcely sufficed to represent the observations, and further investigation has confirmed this idea.

As the result of a threefold interpolation the residuals given below were obtained by comparing the observations with the following approximate parabolic elements referred to the mean equator of 1884·0.

T	1883, Dec. 25·30154 d, G.M.T.
ω'	113° 36′ 50″·5
Ω'	254 33 46·1
i'	110 37 51·1
log q	9·490993.

Observation—Computation.

		R.A. s	δ ″	
1884, Jan.	12	+3·17	−21·0	Melbourne
	17	+1·2	+85·0	,,
	18	+3·50	+ 1·0	,,
	19	+2·43	− 1·8	Windsor, N.S.W.
	21	+1·65	+ 4·2	,,
	21	+2·05	+ 1·1	,,
	22	+1·87	− 0·2	,,
	22	+2·50	− 1·1	Madras.
	23	+1·89	− 2·3	Windsor.
	23	+2·13	−18·6	Madras.
	24	+2·28	+ 2·7	Windsor.
	25	+1·76	− 8·9	,,
	25	+2·06	+ 6·1	Madras.
	26	+2·61	+23·0	,,
	26	+3·55	− 3·2	,,
	27	+1·07	− 8·3	Windsor.
	28	+2·11	−12·4	Melbourne.
	28	+1·96	− 0·1	Windsor.
	28	+2·37	− 1·8	Madras.
	29	+1·90	−14·7	Melbourne.
	30	+3·26	+19·0	Madras.
	31	+0·19	+ 2·8	,,
Feb.	1	−0·25	+ 5·1	Melbourne.
	2	+2·13	− 7·8	Windsor.
	4	+2·47	+ 0·3	Melbourne.

The observations of January 17 and February 1 were rejected for discordance. The observation of January 29 was rejected in order to make the time of the second normal fall at a suitable epoch.

Taking the mean of Tebbutt's observations on January 21, a normal was formed from the observations up to January 22.

Taking the mean of the observations on January 26 and January 28, the second normal was formed from the observations from January 23 to January 28.

Taking the mean of the Madras observations on January 30 and 31, and assigning half weight to the result, the third normal was formed from the remaining observations.

The resulting normals referred to the mean equinox of 1884 January 0·0 are—

	R.A.	δ	
(1)	343° 41′ 0″·7	−41° 47′ 16″·7	for 1884 Jan. 19·0
(2)	350 40 57·7	−41 59 21·7	,, 25·0
(3)	357 13 1·3	−41 44 16·7	Feb. 2·0

From these normals the elements finally deduced are—

T	1883, Dec. 25^{d}·233782	
ω'	113° 16′ 48″·74	Mean Equator, 1884·0.
Ω'	254 32 16·97	
i'	110 31 34·08	
e	0·9944387	
log q	9·4901604	
P	414 years.	

Of course any period deduced from an arc of anomaly of only 14° and from an interval of only 14 days is deserving of little confidence.

These elements give the following residuals in the three normal places :—

Observation—Computation.

Cos δ dR.A.	−0″·6	−1″·3	+2″·8
$d\delta$	0·0	−0·3	−0·1

Referred to the ecliptic of 1884·0 the above elements become—

T	1883, Dec. 25^{d}·233782, G.M.T.	
ω	138° 17′ 59″·05	Mean Ecliptic, 1884·0.
Ω	264 20 17·59	
i	114 54 0·64	
e	0·9944387	
log q	9·4901604.	

The parabolic elements given by Lieut.-General Tennant on p. 26, vol. xlvii. of the *Monthly Notices*, give the following residuals for the above three normal places :—

Observation—Computation.

Cos δdR.A.	$-4''.8$	$-85''.7$	$-141''.4$
$d\delta$	$+612''.5$	$+656''.7$	$+685''.3$

Note.—When the above results were communicated to the Society, I was not in possession of the correction to the inclination of Lieut.-General Tennant's parabola given on p. 394 of the present volume. With this correction the errors (observation—computation) of the parabolic elements are respectively—

Cos δd R.A.	$-17''.1$	$-13''.2$	$+18''.2$
$d\delta$	$-7''.3$	$-6''.5$	$-2''.9$

I think the orbit is undoubtedly elliptic, but what the eccentricity is it is impossible to state with certainty.

The Melbourne observations referred to above are those given in the *Astronomische Nachrichten*, and were published after my former paper on this subject was communicated to the Society.

The Orbits of Comets Fabry and Barnard-Hartwig. By J. Morrison, M.D., Ph.D., Assistant on the American Ephemeris, and Professor of Chemistry in the National University, Washington.

Comet Fabry.

The observations upon which the following hyperbolic elements of this comet are founded are as follow :—

Greenwich M.T.	Appar. α	Appar. δ
d	h m s	° ′ ″
1885, Dec. 7·536032	0 24 46·01	+20 52 34·9
1886, Mar. 7·316539	23 19 42·92	+31 16 44·8*
„ April 1·339713	23 18 30·86	+38 37 57·0
„ June 6·953118	8 47 52·15	−40 38 0·5

The first is a meridian observation made at Ann Arbor; the second results from extra meridian observations made at Greenwich and Paris, the comparison star being the same at both places; the third was made at Bothkamp and was obtained from *Astronomische Nachrichten*, No. 2703; and the fourth was made at Sydney, the comet being at the time "extremely faint, but in a good position for observation with Cape Cat. (1880) 4707," fifty comparisons having been made. (*Monthly Notices*, vol. xlvi. p. 496.) These observations were corrected for aberration and parallax by means of approximate parabolic elements.

* Geocentric.